REMARKS

Claims 1-9 and 91-106 are pending in this application; claims 1 - 4, 105 and 106 are being amended; and claim 90 is being cancelled.

The claim amendments are fully supported by the Specification and add no new matter. For example, the amendments to claim 1, 105 and 106 are supported by the claims as originally filed in this application, and by recently added claim 90.

Claims 2-4 are being amended to cosmetically improve the claims.

Accordingly, entry of the claim amendments and added claims are respectfully requested.

Rejection Under 35 U.S.C 102(b)

I. The Office Action rejected claims 1, 5-7, 90, 92, 93, 95, 96, 100, 103, 104 and 106 under 35 U.S.C. 102(b) as being anticipated by JP 07-073997.

In order to anticipate a reference, each and every element of the claim must be disclosed by a single prior art reference. W.L. Gore & Assocs. V. Garlock, Inc., (Fed Cir. 1983), cert. denied, 469 U.S. 851 (1984).

As amended independent claim 1 reads on a method of etching a substrate in a process chamber comprising a wall, comprising providing a substrate in the process chamber, the substrate having a surface and introducing an etching gas into the process chamber. An RF current is applied through a multi-turn antenna covering a top surface of a chamber wall to pass RF energy through the chamber wall to the etching gas inside the process chamber to energize the etching gas to etch trenches in the substrate. Radiation reflected from the substrate is detected from directly above the surface of the substrate after the radiation propagates through the wall. The detected

radiation is evaluated to monitor the depth of a layer being etched on the substrate.

JP 07-073997 does not anticipate claim 1 because JP 07-073997 does not teach applying an RF current through a multi-turn antenna covering a top surface of a chamber wall to pass RF energy through the chamber wall to the etching gas inside the process chamber to energize the etching gas to etch trenches in the substrate; detecting radiation reflected from the substrate from directly above the surface of the substrate after the radiation propagates through the wall; and evaluating the detected radiation to monitor the depth of a layer being etched on the substrate as claimed in claim 1. Instead, JP 07-073997 teaches a CVD method and device [para 001 et al.]. JP 07-073997 also teaches etching of a sediment deposited on the dielectric window, but the dielectric window of the chamber is not a substrate in the chamber.[para 0019]. Further, JP 07-073997 teaches monitoring a CVD process only while energizing a CVD gas using a single turn antenna as shown in Drawings 10 and 11 and discussed at paragraph 17-19. While JP 07-073997 shows a spiral antenna in Drawings 3 and 4. these versions do not show a process monitoring system operated in relation to the spiral antenna.

JP 07-073997 does not teach independent claim 106, as JP 07-073997 does not teach a method of etching a substrate in a process chamber, the process chamber comprising a ceiling and a multi-turn antenna above the ceiling, the method comprising: introducing an etching gas into the process chamber, energizing the gas by applying an RF current to the multi-turn antenna to pass RF energy through the ceiling of the process chamber to the etching gas inside the process chamber to energize the etching gas, detecting radiation reflected from the substrate from directly above the surface of the substrate after the radiation propagates through the ceiling; and evaluating the detected radiation to monitor etching of the substrate, as claimed in claim 106.

For these reasons, JP 07-073997 does not anticipate claim 1 or claim 106, or the claims dependent therefrom.

Rejection Under 35 U.S.C 103(a)

II. Claims 1-9, 90-106 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 5,846,883 to Moslehi.

This rejection is respectfully traversed. The factual inquiries relevant to the obviousness determination include: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) objective indicia of nonobviousness, which include such "secondary considerations" as the commercial success of the invention, long felt but unsolved needs, unexpected results, and the failure of others to arrive at the invention. Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17, 86 S. Ct. 684, 694 (1966); *See also* KSR Int'l Co. v. Teleflex, Inc., 127 S. Ct. at 1734.

Claim 1 is not obvious by Moslehi because Moslehi does not teach a method of etching a substrate comprising introducing an etching gas into a chamber, applying an RF current through a multi-turn antenna covering a top surface of a chamber wall to pass RF energy through the chamber wall to the etching gas inside the process chamber to energize the etching gas to etch trenches in the substrate; detecting reflecting radiation from the substrate from directly above the surface of the substrate after the radiation propagates through the wall, and evaluating the detected radiation to monitor the depth of a layer being etched on the substrate.

Moslehi teaches a hermetically sealed multi-zone inductively-coupled plasma source that includes individually controlled RF antenna segments. [Abstract]. Mosheli teaches:

> The embodiment of the present invention that FIGS. 1 through 4 describe is a hermetically-sealed multi-zone (HMZ) ICP source.

[Col. 6, lines 20-22.] Thus Moslehi teaches providing power to an inductive coil that is embedded within a chamber wall to inductively couple RF energy into a plasma in a chamber. Moslehi does not teach applying an RF current through a multi-turn antenna

covering a top surface of a chamber wall, detect reflecting radiation from the substrate from directly above the surface of the substrate after the radiation propagates through the wall, and evaluating the detected radiation to monitor the depth of a layer being etched on the substrate.

Further, Moslehi does not teach or suggest, or provide any apparent reason to apply an RF current through a multi-turn antenna covering a top surface of a chamber wall to pass RF energy through the chamber wall to the etching gas inside the process chamber to energize the etching gas to etch trenches in the substrate because Moslehi teaches away from powering a spiral antenna placed above a top surface of the wall. Moslehi teaches:

> Various types of ICP source designs have been proposed in prior art. These include spiral coil antenna designs, helicon wall source designs, and cylindrical coil antenna source designs. However, all the prior art ICP designs share a common constraint or limitation which makes them unable to control or adjust the plasma uniformity profile in real time. The prior art ICP sources are primarily based on single-zone designs and employ single-coil antenna structures with a single RF plasma excitation source. ...
>
> <u>The spiral coil design possesses certain technical advantages, but also has serious limitations. The spiral coil design allows placement of the antenna above a vacuum dielectric plate on the atmospheric side</u> or within the vacuum chamber using an epoxy encapsulation. One can provide a capability to reduce the induced RF voltage across the spiral coil by placing a few capacitors in series with the spiral coil loops. This is not a trivial implementation task since the antenna coil is usually made of water-cooled aluminum or copper tubing. Insertion of the series capacitors may require breaking the tubing water flow by insertion of an in-line metal-to-ceramic insert. Unfortunately, this results in added structural complexity and increased equipment cost. The ICP sources with cylindrical coils around the electrically insulating plasma source or process chamber require an electrically insulating process chamber or plasma source wall material such as quartz tube or aluminum oxide tube used in some source

designs such as the helicon plasma sources. These bulk ICP sources can suffer from plasma non-uniformity problems and usually require a multipolar magnetic bucket inserted between the plasma source chamber and the process environment to generate an expanded uniform plasma. This, however, results in reduced processing throughput due to reduced plasma density and ion flux density at the substrate. Moreover, these sources may generate contaminants and particulates due to sputtering of the plasma source chamber wall material near the excitation RF antenna.

[Emphasis added, Background, Col. 2, line 1 to line 45.]

Thus one of ordinary skill in the art upon reading Moslehi would have no apparent reason for etching a substrate by introducing an etching gas into a chamber, applying an RF current through a multi-turn antenna covering a top surface of a chamber wall to pass RF energy through the chamber wall to the etching gas inside the process chamber to energize the etching gas to etch trenches in the substrate; detecting reflecting radiation from the substrate from directly above the surface of the substrate after the radiation propagates through the wall, and evaluating the detected radiation to monitor the depth of a layer being etched on the substrate, as claimed in claim 1.

For similar reasons, Moslehi does not teach or suggest a method of etching a substrate in a process chamber by introducing an etching gas into the process chamber; powering a non-vertical multi-turn antenna covering a top surface of a chamber wall to couple energy through the wall to the etching gas inside the process chamber to energize the etching gas to etch the layer on the substrate; detecting radiation reflected from the substrate and propagating through the wall; and evaluating the detected radiation to monitor the depth of the layer being etched on the substrate, as claimed in claim 105.

For similar reasons Moslehi does not teach or suggest a method of etching a substrate having a surface by introducing an etching gas into the process chamber; applying an RF current to a multi-turn antenna to pass RF energy through the ceiling of the process chamber to the etching gas inside the process chamber to energize the etching gas; detecting radiation reflected from the substrate from directly above the surface of the substrate after the radiation propagates through the ceiling; and evaluating the detected radiation to monitor etching of the substrate, as claimed in claim 106.

In view of these remarks, Applicant requests the Examiner to reconsider the present application and allow the pending claims. Should the Examiner have any questions regarding the above amendments or remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES

A PROFESSIONAL CORPORATION

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By ______________
Ashok Janah
Reg. No. 37,487

Please direct all telephone calls to: Ashok K. Janah at (415) 538-1555.

Please send correspondence to:

Janah & Associates, P.C.
650 Delancey Street, Suite 106
San Francisco, CA 94107.